COEN COMPANY Inc.
Combustion Engineers and Manufacturers Since 1912
1510 ROLLINS ROAD, BURLINGAME, CALIFORNIA 94010, TELEPHONE: 415-697-0440
TELEX: 03-4337 CABLE: COENBURNER

February 7, 1985

Northwest Tank Service
1500 Airport Way South
Seattle, WA 98134

Attention: Mr. L.E. Wilkinson

Subject: Seattle City Light
Fuel Oil PCB Incineration System

Dear Mr. Wilkinson:

Enclosed you will find our quotation to supply an incineration system for Seattle City Lights' polychlorinated biphenyl compounds (PCB's) ladden fuel oil. The system as quoted is in compliance with the Seattle City Light RFP 42672. In addition the system will also comply with the requirements of U.S. Codes of Regulations for the Protection of the Environment part 40 CFR 761.70 addressing the incineration of PCB's. Based on our experience with similar liquid wastes, Coen company will guarantee a destruction and removal efficiency (DRE) of 99.9% for all PCB compounds in the fuel oil. Coen Company is approved by the United States Environmental Protection Agency as a qualified manufacturer of hazardous waste incineration systems. In addition, based on over seventy years of experience, we feel that a test firing of this fuel is not required to verify our DRE guarantees.

I hope that our proposed incineration will meet with your satisfaction, and feel free to call me if you have any questions.

Very truly yours,
COEN COMPANY INCORPORATED

Richard A. Brown, Sales Application Engineer
Duct Burners and Incineration Systems

RAB/bb
0218q

cc: Western Combustion Incorporated
Lynnwood, Washington 98036
Attention: Mr. David N. Eaden

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QUOTATION NO.
SP-85-042

Northwest Tank Service
1500 Airport Way South
Seattle, WA 98134

February 7, 1985

Attention: Mr. L.E. Wilkinson

Subject: Seattle City Light
Fuel Oil PCB Incineration System

Dear Mr. Wilkinson:

For your application of providing for the incineration of PCB contaminated fuel oil held at the Lake Union Steam Plant, Coen offers the following equipment:

I. INCINERATOR

One (1) Coen combination natural gas/#2 oil fired waste incinerator, for thermal oxidation of liquid wastes. The incinerator will consist of a refractory lined combustion chamber with integral combustion air windbox. The incinerator will be fired with a Coen register type burner. The incinerator package will include the following components:

A. One (1) refractory lined combustion chamber. The chamber will be approximately 12'-0" O.D. by 28'-0" overall length. Integral with the chamber will be a 2' windbox. The firing chamber will be lined with a two component refractory lining, consisting of 6" Harbison-Walker insulating firebrick and 6" of Harbison-Walker Ufala super duty firebrick on the hot face. The refractory will be field installed by Coen. The anchor spacing and type will be in accordance with recommendations of the refractory supplier. The estimated shell temperature is 280° F with a hot face temperature of 2250° F, 70° F ambient, no wind. The resulting inside combustion chamber dimensions will be 10'-0" by 23'-0" long. The system is designed for a maximum heat input of 30.0 million BTU/HR (LHV), with a design residence time of 2.0 seconds in the chamber.

B. One (1) Coen DAZ-20 air register. The air register will be mounted in the incinerator windbox. The register will be supplied with manually adjusted louvers. The Coen DAZ register is designed to impart a rotary motion to the combustion air. Utilizing two sets of multiple adjustable louvers, two concentric air streams are produced, each with opposite rotations providing excellent mixing. This type of burner does not require high fan horsepower to achieve excellent mixing.

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C. One (1) Coen #2 MV steam atomized #2 oil burner with integral blowout cock, and one (1) spare. These oil atomizers will be used for incinerator chamber warm-up, or for sustaining heat input.

D. One (1) set burner socket piping to allow atomizer change over without shutdown. Includes two (2) hand valves for steam, two (2) for oil.

E. One (1) Coen stainless steel ring-type natural gas burner.

F. One (1) Coen Fyr-Lyter gas pilot (spark ignited, 300,000 BTUH, designed for continuous duty).

G. Two (2) Coen #2 MV steam atomized waste fuel oil atomizers, each with one steam hand valve and one waste fuel oil hand valve, and piped to a common connection point.

II. PIPING ASSEMBLIES

The following piping assemblies will be factory assembled, wired, and mounted on a free-standing piping rack. All piping and valving will be of steel construction with all electrical construction rated for NEMA-4. The following will be included:

A. One (1) pilot gas piping train assembly. The assembly will consist of the following components:

1. One (1) 1/2" pilot gas pressure regulating valve
2. One (1) 3/8" solenoid vent valve
3. Two (2) 1/2" solenoid safety shutoff valves
4. One (1) 1/2" hand shutoff valve
5. One (1) 4-1/2" diameter pressure gauge

B. One (1) main gas piping train assembly. The train is to receive a regulated supply of natural gas at 20 psig. The piping train assembly will consist of the following components:

1. One (1) 1-1/2" inlet "wye" strainer
2. One (1) 1-1/2" air operated flow control valve with three valve bypass.
3. One (1) 3/4" solenoid vent valve
4. Two (2) 1-1/2" motorized safety shutoff valves

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5. One (1) 1-1/2" hand shutoff valve
6. Two (2) 4-1/2" diameter pressure gauges

C. One (1) liquid waste fuel oil piping train assembly. Required supply pressure is 100 psig. The piping train assembly will consist of the following components:

1. One (1) 3/4" inlet strainer
2. One (1) 3/4" motorized fuel shutoff valve
3. One (1) 3/4" hand valve
4. One (1) steel flexible hose
5. One (1) 3/4" air operated flow control valve with three valve bypass.
6. Two (2) 4-1/2" diameter pressure gauges

D. One (1) #2 oil piping assembly. Required supply pressure is 100 psig. The assembly will consist of the following components:

1. One (1) 3/4" inlet strainer
2. One (1) 3/4" motorized fuel shutoff valve
3. One (1) 3/4" hand valve
4. One (1) steel flexible hose
5. One (1) 3/4" air operated flow control valve with three valve bypass.
6. Two (2) 4-1/2" diameter pressure gauges
7. One (1) 1" supervisory hand valve for selection of #2 oil or liquid waste.

E. One (1) atomizing steam piping train assembly for liquid waste fuel oil or #2 oil atomizers. 100 psig saturated steam will be used. The assembly will consist of the following components:

1. One (1) 1" inlet strainer
2. One (1) 1" pressure differential control valve
3. One (1) 1" hand valve
4. One (1) 1" motorized shutoff valve
5. One (1) steel flexible hose
6. One (1) 4-1/2" diameter pressure gauge

F. Instrument air piping including filter/regulators, solenoid valves, etc. to provide air for control signals, actuator power, etc.

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III. CONTROL PANEL AND SAFETY INTERLOCKS

Coen will provide a local control panel and safety interlocks to insure safe start-up and operation of the incinerator package. The local panel will be a free-standing NEMA-4 cabinet.

A. One (1) Coen Fyr-Monitor flame safeguard system. The system will be designed to insure safe start-up and operation of the incinerator. The start-up sequence will include: purge (purge ready and purge complete) indication; 15 second trial for main gas flame and post shutdown purge. Warm-up of the incinerator will be by using natural gas or #2 oil. After warm-up the waste fuel oil can be introduced into the incinerator. The following safety interlocks are included to insure safe operation of the incinerator:

1. One (1) low liquid waste fuel oil supply pressure switch
2. One (1) low #2 oil supply pressure switch
3. One (1) low steam/liquid differential pressure switch
4. One (1) low atomizing steam supply pressure switch
5. One (1) low gas pressure supply switch
6. One (1) high burner natural gas pressure switch
7. One (1) low combustion air flow switch
8. One (1) high steam pressure switch
9. Three (3) water column relays
10. One (1) high furnace pressure switch
11. Two (2) high furnace temperature switches
12. Two (2) forced draft air damper position switches
13. Two (2) flame scanners (redundant)
14. One (1) high scrubber inlet temperature switch
15. One (1) high quench pot temperature switch
16. One (1) low quench pot liquid level switch
17. One (1) low quench water flow switch
18. Miscellaneous valve position switches

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B. Combustion controls will be provided by Coen to modulate the combustion air flow to maintain the furnace incineration temperature of 2250° F. Included in the system are the following components:

1. One (1) type "K" thermocouple with thermowell
2. One (1) furnace temperature transmitter
3. One (1) furnace temperature indicating controller
4. One (1) current to pneumatic signal converter
5. One (1) pneumatically actuated forced draft fan damper actuator

Liquid waste fuel oil, natural gas, or #2 fuel oil flows will be manually controlled by panel mounted hand stations. In order to prevent an overtemperature condition should air flow decrease, an overriding control system will be provided to automatically decrease the fuel flows.

The following components are included in the system:

6. One (1) type "K" thermocouple with thermowell
7. One (1) furnace temperature transmitter
8. One (1) furnace temperature indicating controller
9. One (1) current to pneumatic signal converter
10. Two (2) pneumatic low select relays
11. Three (3) pneumatic panel mounted manual loaders for natural gas, #2 fuel oil, and liquid waste fuel oil flow control.

C. Flue gas analysis equipment. Coen will supply one (1) complete packaged flue gas sampling and analysis system. The system will come completely assembled in a Nema 4 electrical enclosure 48" wide, 72" high, and 30" deep. The system includes all necessary contacts, analog signals, etc. as required. The necessary instrument calibration gases must be supplied by others. The system will contain the following major components:

1. One (1) stack sampling probe package.
2. One (1) stack sample conditioning system.
3. One (1) Beckman Model 865 NDIR carbon monoxide analyzer.
4. One (1) Beckman Model 755 paramagnetic oxygen analyzer.
5. Two (2) Beckman 190906 auto zero span modules.
6. One (1) two-pen strip chart recorder.
7. One (1) manually operated probe blowback pushbutton.

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IV. WASTE HEAT RECOVERY BOILER

One (1) Deltak Model L-OHB-1040-SE Dino waste heat recovery boiler designed to produce 20,000 LBS/HR of 500°F steam at 250 PSIG. The boiler will be 8'-0" wide, 16'-0" tall, and 35'-0" long. The boiler and trim description is as follows:

A. Boiler General

The "Deltak" heat recovery boiler is a shop assembled, two drum natural circulation watertube unit. The compact size and versatility of gas flow connections are the result of a unique bent tube arrangement. The symmetrical design of the heating surface allows the gas flow to enter and exit the boiler horizontally.

The two drum Delta design provides circulation reliability, using unheated downcomers and vertical steam generating tubes connected to large accessible drums.

The boiler is completely enclosed in a shop-assembled, refractory lined, gas-tight casing and mounted on a rigid structural steel base.

B. Drums

Boiler drums are fusion welded, meeting the requirements of the current edition of th ASME Boiler and Pressure Vessel Code, Section I and inspected by the Hartford Steam Boiler Inspection and Insurance Company.

The steam drum size is 36" I.D. The lower drum is 24" O.D. The steam drum material is SA515 Grade 70 and the lower drum material is SA016B. The thickness of the drum materials includes a minimum of 1/16" corrosion allowance.

Each drum will have a 12" x 16" elliptical manway in each end, complete with covers, yokes and gaskets.

All tube holes are drilled radially for full bearing of each tube through the drum wall. Each tube hole is accurately machined to close tolerance and the tube to drum plate connection is made by expanding the boiler tube into the drum plate with torque controlled tube expanders.

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The lower drum provides for low velocity settlement of boiler water solids, collection and removal by means of an intermittent blow-off.

C. Drum Internals

Feedwater Distributor:

An internal feedwater distribution pipe located in the steam drum distributes the feedwater adjuacent to the downcomers.

Chemical Feed Distributor:

An internal chemical feed line is located in the steam drum to distribute liquid chemical boiler water treatment additives.

Continuous Blow-Down:

An internal pipe located in the steam drum for deconcentration of solids in boiler water is provided.

Steam Separation:

The steam drum contains a two-element steam separating system to provide a steam quality at the boiler outlet of 1 ppm maximum solids carryover with total solids concentration of the boiler feedwater in accordance with recommended standards of the American Boiler Manufacturers Association.

The primary steam separator will baffle the steam generating tubes and direct the steam discharge above the normal water level in the steam drum to prevent disturbance of the water level and separate the steam/water mixture by centrifugal force.

The secondary steam separation is by a 304 stainless steel mesh-type "Demister" framed and installed at the steam outlet.

D. Tubes

All boiler tubes are 2" O.D. electric-resistance-welded carbon steel, material specification ASTM A-178-A. Tube wall thickness is .105" minimum.

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Fins are serrated type, 5/32" segment, 3/4" high and continuously welded to the tubes with electric resistance welding.

All tubes are bent on a uniform radius of 8", allowing for internal cleaning with a standard tube cleaner. The tubes are arranged "in-line" with spacing for easier cleaning, maintenance and optimum heat transfer with low draft loss. All tubes are completely drainable.

Each tube is bent to a 90° angle at midpoint to form the two gas pass arrangement by a 304 stainless steel baffle.

E. Refractory and Insulation

The boiler casing is internally lined with a two-layer, castable refractory, anchored to the casing with 304 stainless steel "V" anchors. The inside layer of refractory is 4" thick 50-60 LBS/cubic foot density. The outside layer of refractory is 2" thick 20-25 LBS/cubic foot density. Both drums are covered with 2" thick mineral wool blanket of 10 LBS/cubic foot density and covered with 12 gauge carbon steel lagging.

The drum ends will have insulation rings around the manway openings to facilitate field insulation of the drum heads by others.

F. Casing

The boiler is enclosed in a 7 gauge carbon steel, gas-tight outer casing reinforced with structural steel stiffeners welded to the casing exterior. The casing is designed to 15" w.c. pressure.

The boiler casing average cold face temperature will not exceed 140 degrees F, with an ambient temperature of 80 degrees F and a surface wind velocity of two feet per second while the unit is operating at full rated load.

G. Base and Structural

The boiler assembly is supported by a heavy structural steel base, and allowed to expand freely inside the setting. The structural steel framework and base will support the boiler setting as well as a nominal dead static load for small superheater, economizer or stub stack.

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H. Access Door

The boiler will include one (1) 15" x 18" access door through the boiler setting. This door is located on the back side for access to the gas side area between the two gas passes.

I. Paint

The external surface of the boiler and drums will be painted in accordance with the project paint specification BWC-23-001. Ladders, platforms, etc. will be hot dipped galvanized.

J. Feedwater Regulator

A single element air operated feedwater regulator system is furnished, complete with piping, valves and accessories, installed. The system is designed to maintain the water level in the steam drum within the normal operating limits for good steam generation and protection against low water condition.

The level controller is a Fisher Level-trol with a displacement type sensor and proportional pneumatic controller with a 3-15 psig output to a Fisher type "ES" control valve with a "657" direct acting diaphragm actuator. The feedwater system includes three Edward 848Y isolating and bypass valves, two 1-1/2" Edward 848Y drum level shutoff valves and one 3/4" Edward 848Y drain valve.

K. Sootblowers and Piping

The sootblower system will consist of two Copes - Vulcan Model D-5 manual, rotary sootblowers using saturated steam as the blowing medium. A two step gear train provides a 15:1 wheel to valve ratio for instant opening of the valve. The valve can be adjusted to bring the blowing medium up to the correct pressure and flow as the sweep of the jets reaches the boiler surfaces. A scavenging air valve is furnished to keep both head and element under pressure at all times that the blowing medium is shut off to protect the element against corrosion. The sootblower valve, bearings and properly selected element are shop installed.

A complete set of steam supply piping with fittings and valves are furnished, including a 2" Edward 849Y steam stop valve with operating chainwheel, two 3/4" Edward 2698Y condensate drain valves and one 3/4" Armstrong 981 strainer and trap.

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L. Boiler Trim

The following trim will be furnished and piped up to each unit. This trim and piping will be removed only to the extent as required to prevent damage during shipment. The removed trim will be crated and shipped as a separate package to be reinstalled on the job site by customer. Hydrostatic testing of piping to be by customer.

Description	No.	Size	Make	Type
Safety Valve	1	1-1/2"	Consolidated	1811HA @ 250
	1	1-1/2"	Consolidated	1811HA @ 255
Steam Pressure Gauge	1	8-1/2"	Ashcroft	1010-A
Steam Gauge Syphon	1	1/4"	Ashcroft	1098-S
Steam Gauge Cock	2	1/4"	Ashcroft	1/4-7001
Water Gauge Glass	1	10-1/8"	Reliance	C-7
Gauge Glass Valves	1 set	3/4"	Reliance	403-RS
Water Gauge Drain Valve	1	3/8"	Edward	2698-Y
Try Cocks	3	3/4"	Reliance	GC-451
Water Column	1	---	Deltak	DW-400
Hi-Low Water Alarm	1	---		Included
Low Water Cut-Off	1	---		Included
Water Column Drain Valve	2	3/4"	Edward	2698-Y

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Description	No.	Size	Make	Type
Feed Valve	1	1-1/2"	Edward	848-Y
Feed Check Valve	1	1-1/2"	Edward	838-Y
Drum Blowoff Valve	1 set	1-1/2"	Edward	1441-1443
Continuous Blow Down Stop Valve	1	3/4"	Edward	2698-Y
Continuous Blow Down Regulating Valve	1	3/4"	Hancock	5525-Y
Vent Valve	2	3/4"	Edward	2698-Y
Drain Valve	1	3/4"	Edward	2698-Y
Main Steam Non-Return Valve	1	4"	Crane	30-E

V. FLUE GAS QUENCH POT AND PACKED BED SCRUBBER

Coen will supply one (1) flue gas water quench chamber at the discharge of the waste heat boiler. This quench system will utilize multiple water spray nozzles to drop the flue gas temperature from 400°F to 150°F before entering the scrubber. The chamber will be fabricated using 1/4" type 304 stainless steel. The quench chamber will require a cooling water flow of 5.7 GPM and will be controlled as a function of chamber discharage temperature.

Coen will also supply one (1) Interel Model GW-180 Arasin packed bed scrubber for hydrochloric and sulfuric acid removal, and for particulate removal. The scrubber housing and all parts are made from corrosion-resistant polypropylene, with the electrical control panel located at the burner piping/control skid. The electrical conrol panel will be used for caustic level, and PH control. The scrubber is designed for storage of the spent scrubbing liquid in the sump of the unit for periodic recycling or disposal. The scrubber will be approximately 11'-5" high and 6'-0" in diameter.

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The scrubber will come complete with six (6) feet of Tellerette packing, polypropylene demister, PVC piping, PVC spray nozzles, and a circulation pump driven by a 5 HP TEFC motor and rated at 112 GPM at 15 PSIG. The scrubber will have a removal efficiency of 99.0% on hydrochloric acid using a NaOH caustic solution.

VI. FLUE GAS REHEAT STEAM COIL

Coen will also supply a flue gas reheat steam coil. This coil will reheat the flue gases from approximately 140° F to 275° F. The purpose of this coil will be to eliminate a water vapor plume at the stack exit. This coil will use approximately 2,200 LBS/HR of saturated steam from the waste heat recovery boiler.

VII. FORCED DRAFT FAN

A forced draft fan rated at 10,200 SCFM at 12" w.c. discharge will be provided. Fan will be arrangement 4, top horizontal discharge, driven by a 30 HP, 1800 RPM TEFC high efficiency motor. An inlet vane control damper is included, with Bailey pneumatic actuator.

VIII. EXTENT OF PREPACKAGING AND SITE WORK REQUIRED

A. Coen will design a system that will be prepackaged to the maximum practical extent. Major pieces requiring field erection, and interconnection (piping, wiring, tubing) will be:

1. Refractory lined (lining installed at the jobsite) combustion chamber complete with burner equipment installed.
2. Heat recovery boiler with economizer & trim piping.
3. Piping and control skid.
4. F.D. fan.

All interconnecting ductwork from the incinerator windbox inlet to the scrubber discharge will be supplied by Coen. Some boiler trim piping will require field assembly. Some instrumentation will also require field mounting, only where shop installation is not possible.

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B. Work Not Supplied By Coen:

1. Site preparation, including foundations, anchor bolts, and civil work involved.
2. Piping to and from the incinerator package.
3. Wiring to and from the incinerator package.
4. Feedwater treatment.
5. Field erection.
6. Installation of miscellaneous loose instrumentation.

IX. SYSTEM DESIGN CRITERIA & PERFORMANCE

Incinerator Heat Release	30.0 MM BTUH (LHV)
Operating Temperature	2250° F
Combustion Air Flow	45,900 PPH
Quench Water Flow	2,940 PPH
Residence Time	2.0 second
Boiler Steam Production	20,000 PPH
Blowdown Rate	350 PPH

Guaranteed Incineration Destruction and Removal Efficiency (DRE) of polychlorinated biphenyl compounds is 99.9% .

X. PROJECT SCHEDULE

WEEKS ARO	EVENT
------	Order placement
Four (4)	General arrangement drawings, loadings, P&ID (see Appendix E.)
Eight (8)	All drawings and technical data for approval (see Appendix E.)
Twelve (12)	Drawing approval/fabrication release

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Sixteen (16)	Initiate shop fabrication
Thirty (30)	Ship all equipment to jobsite
Thirty-Four (34)	Commissioning

XI. EQUIPMENT WEIGHTS AND FOB POINTS

	WEIGHT	F.O.B.
Refractory Lined Combustion Chamber	211,000 LBS.	Seattle, WA *
Burners, Piping & Instrumentation	5,000 LBS.	Burlingame, CA
Boiler / Economizer	38,000 LBS.	Minneapolis, MN
Fan	1,600 LBS.	Chicago, IL

* We would use fabricators and contractors in Seattle, Washington for the steelwork and refractory.

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XIII. PROPOSED PAYMENT SCHEDULE

Contract payments shall be based on progress according to the following schedule. Payment terms are net thirty (30) days. Events may not necessarily occur in the order listed.

10%	On submittal of all drawing for approval.
10%	On drawing approval and notice to proceed with fabrication.
10%	On start of shop fabrication.
15%	On completion of burner, piping & controls, and fan
15%	On completion of incinerator steel fabrication.
15%	On completion of refractory lining.
20%	On completion of heat recovery boiler.
5%	After successful commissioning, not to exceed six (6) months after shipment.

XIV. OTHER COMMERCIAL ITEMS

A. Equipment Performance

Coen Company will provide a performance bond to cover the operational performance of the Coen supplied equipment. This bond will cover our guarantees on the destruction and removal efficiency as described above. Coen can not, at this time, provide a performance bond cover complete complience with the requirements of the Environmental Protection Agency Region X. It is the opinion of Coen Company that we will comply with these requirements, however we have not had sufficient time to arrange this bonding.

B. Warranty

Coen Company will warrant the equipment for twelve (12) months after startup or eighteen (18) months after shipment, whichever is less. Piping, instrumentation and burner management are to be stored indoors in a protective environment during the storage period. Startup by Coen personnel (on a per diem basis) will be required.

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C. Validity Period Escalation

Prices are firm for acceptance within ninety (90) days from the date of this proposal, and for shipment within twelve (12) months from the date of this proposal. For orders delayed beyond the normal delivery period, through no fault of Coen Company, escalation will apply in accordance with the Wholesale Price Index for Industrial Commodities.

D. Taxes

Sales tax, personal property tax, use tax, excise tax, or other taxes imposed by Federal, State, or Municipal authority and incurred by vendor through performance of the contract shall be for the purchaser's account, and are in addition to the prices quoted in this proposal.

E. Field Service

The enclosed form "Coen Domestic Field Service and Rates" is to be considered a part of this quotation.

Thank you for your inquiry. We hope to be of service to you.

Very truly yours,
COEN COMPANY, INCORPORATED

Richard A. Brown, Sales Application Engineer
Duct Burners & Incineration Systems

RAB/bb
0218q

cc: Western Combustion Incorporated
Lynnwood, Washington
Attention: Mr. David N. Eaden